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(54) **SYSTEM AND CIRCUIT FOR TELEVISION POWER STATE CONTROL**

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H04N 21/443 (2011.01)

(52) **U.S. Cl.**
CPC ***H04N 21/4432*** (2013.01); ***H04N 5/63*** (2013.01)

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CPC H04N 21/4432; H04N 5/63
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See application file for complete search history.

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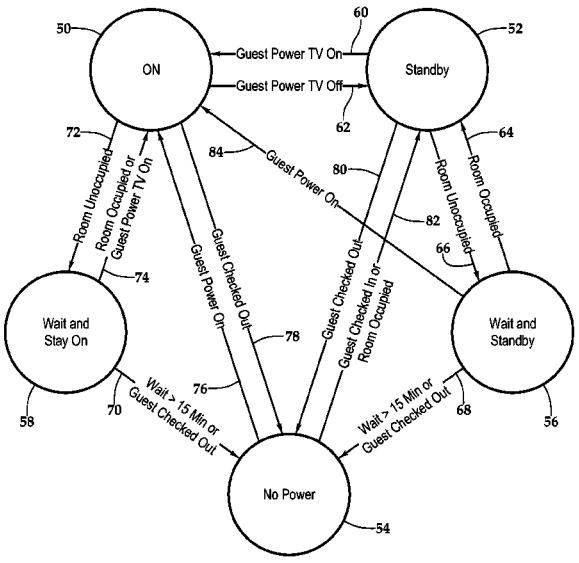
(57) **ABSTRACT**

A system and circuit for television power state control are disclosed. In one embodiment, a power management circuit is coupled to a television and interposed between a video feed and an image display engine as well as between an audio feed and a speaker. The power management circuit selectively alternates the television between three states: powered ON/operating state (first state); power standby state (second state); and no/low power state (third state). Utilized with a television in a commercial application, the system and circuit are employed to provide accelerated turn-on time to receive an image for user interaction, while providing sufficient control to maintain energy power savings.

18 Claims, 2 Drawing Sheets



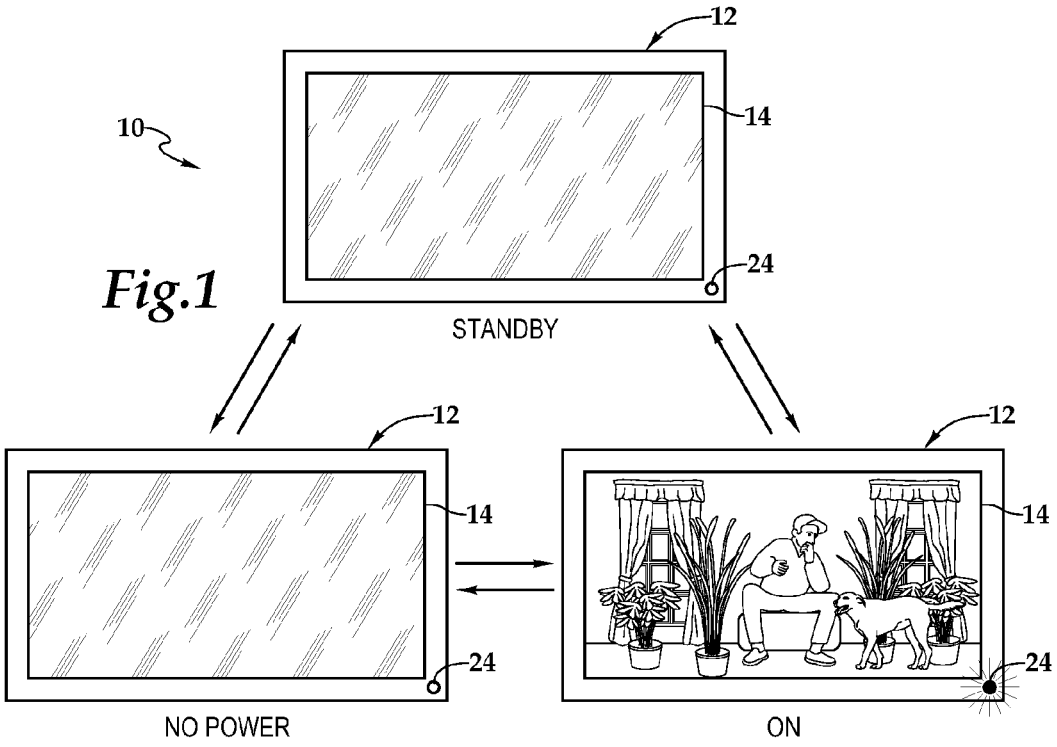


Fig.1

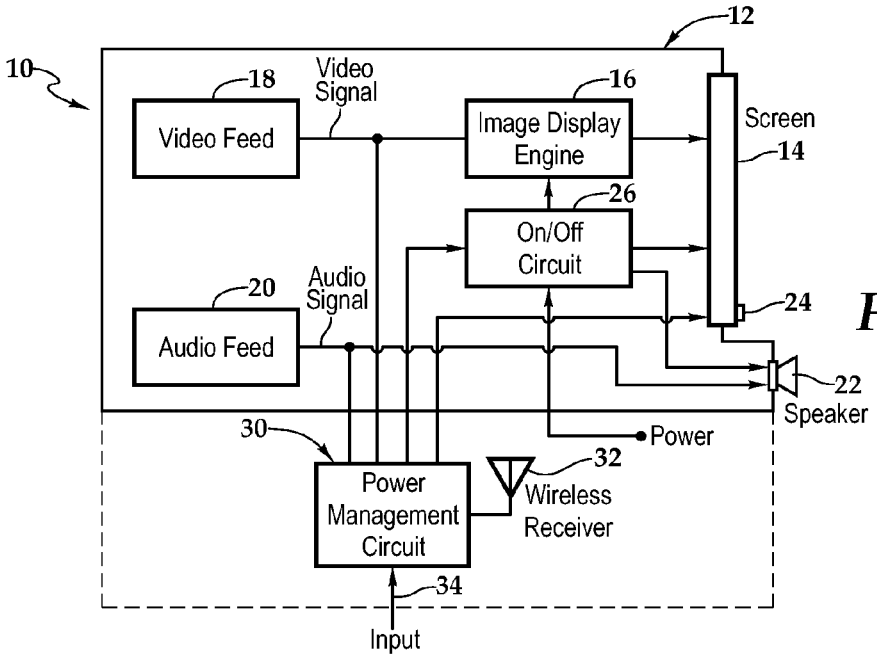


Fig.2

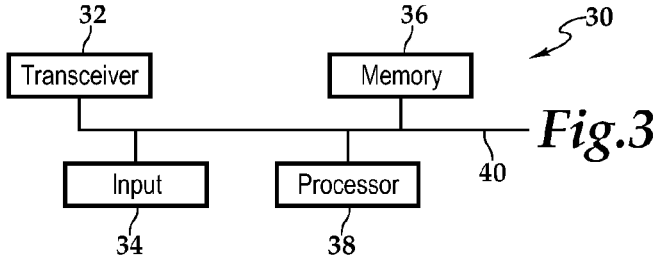


Fig.3

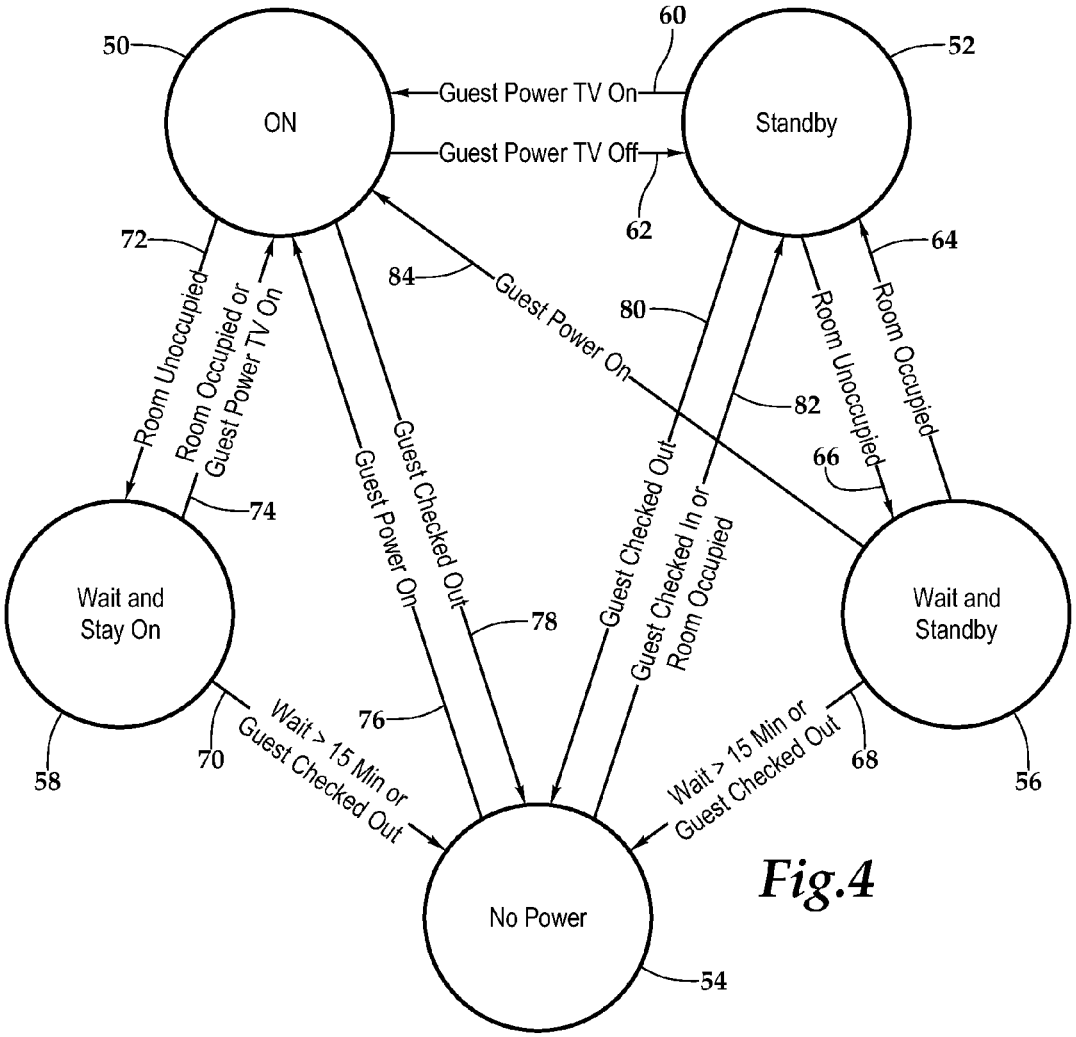


Fig.4

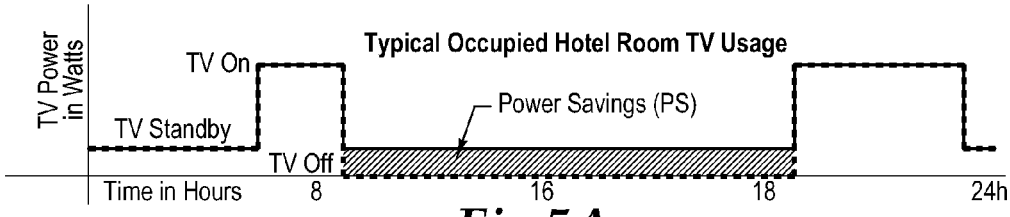


Fig.5A

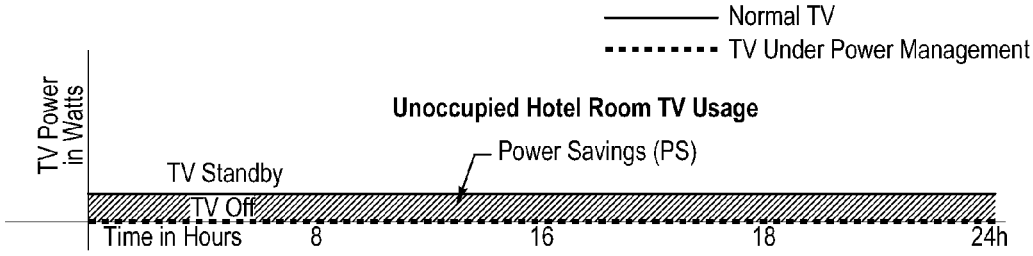


Fig.5B

SYSTEM AND CIRCUIT FOR TELEVISION POWER STATE CONTROL

PRIORITY STATEMENT & CROSS-REFERENCE TO STATE CONTROL

This application claims priority from co-pending U.S. Patent Application No. 61/359,251, entitled "System and Method for Television Power State Control" and filed on Jun. 28, 2010, in the names of Johns et al.; which is hereby incorporated by reference for all purposes.

TECHNICAL FIELD OF THE INVENTION

This invention relates, in general, to the control of the power state of a television and, in particular, to a system and circuit for facilitating acceleration from no power/low power states to powered ON/operating states.

BACKGROUND OF THE INVENTION

Without limiting the scope of the present invention, its background will be described with reference to power state control in commercial applications, such as hotels. When placing a television in a commercial environment for independent operation by a customer or end-user, television power-on can present significant issues for operation, continuing support and costs. Typically, televisions in hotels and other guest-serving environments turn ON slowly by charging the system from a stand-by state, where very low power is consumed in order to conserve energy during long periods of inactivity. This power-up from the standby state can take between four and 20 seconds depending on the design of the television. Such a delay results in customer complaints.

SUMMARY OF THE INVENTION

It would be advantageous to achieve power state control in a commercial environment, such as a hotel. It would also be desirable to enable an electrical/programming-based solution that would save power. To better address one or more of these concerns, systems and methods are disclosed for television state power control. In one embodiment, a power management circuit is coupled to a television and interposed between a video feed and an image display engine as well as between an audio feed and a speaker. The power management circuit selectively alternates the television between three states: powered ON/operating state (first state); power standby state (second state); and no/low power state (third state).

In one implementation, the system and method are utilized with a television in a commercial application that can be controlled in a specific manner to provide accelerated turn-on time to receive an image for user interaction, while providing sufficient control to maintain energy power savings. The resulting controlled system meets key requirements for guests of hotels, as well as other venues, such as medical facilities, stadiums, and other commercial television locations, where a television owned by a facility is provided to a customer end user for operation.

In one embodiment, the system combines the interaction of a user and commercial television for the purpose of self directed use. Through the combination of components the television can "Turn-on," meaning provide the user with a TV that is on and has a picture on the screen, within 1-second of the pressing of the "power" or "power ON" button on a remote control or front of TV. In this embodiment, through blanking of video, control of image lighting (back-light, LED, side-light or emissive lighting) and modification of the stand-by indicator state in the television, the desired "Instant On" results can be delivered and controlled for energy savings. Elements inside the television may include a video signal, audio signal, lighting/backlighting, indicator lights and elements of control/interaction may include a user remote control, TV bezel button, external control device or sensors, room entry system, and business/rules logic. These and other aspects of the invention will be apparent from and elucidated with reference to the embodiment(s) described hereinafter.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the features and advantages of the present invention, reference is now made to the detailed description of the invention along with the accompanying figures in which corresponding numerals in the different figures refer to corresponding parts and in which:

FIG. **1** is schematic diagram depicting one embodiment of the system for television power state control being utilized in conjunction with a television;

FIG. **2** is a schematic diagram depicting the system in FIG. **1** in further detail;

FIG. **3** is a schematic diagram depicting one embodiment of a power management circuit depicted in further detail;

FIG. **4** is a state diagram depicting one embodiment of state transitions and a method for television state power control;

FIG. **5**A is a graph of one embodiment of power savings in a typical occupied commercial environment; and

FIG. **5**B is a graph of one embodiment of power savings in a typical unoccupied commercial environment, wherein FIGS. **5**A and **5**B share a common legend.

DETAILED DESCRIPTION OF THE INVENTION

While the making and using of various embodiments of the present invention are discussed in detail below, it should be appreciated that the present invention provides many applicable inventive concepts which can be embodied in a wide variety of specific contexts. The specific embodiments discussed herein are merely illustrative of specific ways to make and use the invention, and do not delimit the scope of the present invention.

Referring initially to FIGS. **1** and **2**, therein is depicted a system for television power control that is schematically illustrated and generally designated **10**. A television **12** is illustrated that includes a display **14** having an image display engine **16** associated therewith. The television also includes a video feed **18** providing a video signal and an audio feed **20** providing an audio signal to speakers **22**. A visual indicator **24** associated with the display **14** of the television **12** informs the user of the status of the television. An ON/OFF circuit **26** coupled to a power source powers the television **12**. The ON/OFF circuit **26** also provides low power.

A power management circuit **30** is interposed between the video feed **18** and the image display engine **16**. Additionally, in one embodiment, the power management circuit **30** is disposed in communication with the visual indicator **24** and interposed between the audio feed **20** and speakers **22** associated with the television **12**. As shown, the power management circuit **30** is also disposed in communication with the ON/OFF circuit **26** to control no power/low power settings. As will be discussed in further details hereinbelow, the power management circuit **30** selectively alternates the television **12** between three states: powered ON/operating state (first state); power standby state (second state); and no power/low power state (third state).

At least one receiver is coupled to the power management circuit **30** and configured to receive an activity signal relative to environment activity status. In one implementation of the receiver, a wireless receiver **32** is coupled to the power management circuit **30** in order to receive a wireless activity signal from a monitoring unit, such as an occupancy sensor or remote, located proximate to the television. Moreover, a cabled-input **34** may also form a portion of the power management circuit **30** in order to receive activity signals from a networked source, such as the front desk or backend of a hotel or door lock or light switch, in certain commercial environments.

Referring now to FIGS. **2** and **3**, the power management circuit **30** may form a portion of the television **12** or, alternatively, form a portion of a set top/back box. In one embodiment, the power management circuit **30** includes the wireless receiver or transceiver **32**, input **34**, memory **36**, and a processor **38**, all interconnected by bus **40**. In this embodiment, the processor **38** is coupled to the wireless transceiver **32** and the input **34**. The processor **38** is also configured to communicate with the video feed **18**, the audio feed **20**, the image display engine **16**, the visual indicator, and the ON/OFF circuit **26**.

The memory **36** is accessible to the processor **38** and the memory **36** includes processor-executable instructions that, when executed, cause the processor **38** to selectively alternate between the first state, the second state, and the third state based on received data relative to the environment status e.g., occupancy in the room and desire to watch television. In the first state, the processor **38** drives first signaling to pass the video signal from the video feed **18** to the image display engine **16** and pass the audio signal from the audio feed **20** to a speaker **22**. The first signaling also includes driving the visual indicator **24** to display television ON.

In the second state, the processor **38** drives second signaling to the image display engine **16** to blank the video signal, while maintaining synchronization with the image display engine **16**. The second signaling also includes blocking the audio signal from the audio feed **20** to the speaker **22** and driving the visual indicator **24** to display television OFF. In the third state, the processor **38** drives third signaling to turn the video feed OFF and to turn the audio feed OFF as well as driving the visual indicator to display television OFF. In one embodiment, in the third state, the processor **38** drives a signal off to the ON/OFF circuit to turn OFF the television **12** or place the television in a low power state. Additionally, in one implementation, when transitioning from the first state to the third state or from the second state to the third state, the processor may decrement a timer or time period. In this implementation, the power state control change is not made until the timer is decremented to zero or a signal is received indicating that the occupant is not returning.

Referring now to FIG. **4**, as mentioned, the power management circuit selectively alternates the television between three states: powered ON/operating state (first state **50**); power standby state (second state **52**); and no power/low power state (third state **54**). In the first state **50**, the power management circuit passes the video signal to the image display engine and, similarly, the power management circuit passes the audio signal to the speaker. As shown, the first state **50** includes the visual indicator displaying television ON. The second state **52** includes the power management circuit blanking the video signal to the image display engine, while maintaining synchronization with the image display engine. Moreover, the power management circuit blocks the audio signal to the speaker. The second state **52** includes the visual indicator displaying television OFF. The third state **54** includes the power management circuit turning both the video feed and audio feed OFF. Therefore, synchronization between the video feed and the television is lost. The third state **54** also includes the visual indicator displaying television OFF.

The powered ON/operating state (first state **50**) is optimally consuming power for an occupied television environment and power ON television. The power standby state (second state **52**) is optimized for an occupied television environment and power OFF television, while the no power/low power state (third state **54**) is optimized for an unoccupied television environment and power OFF television. In one embodiment, the power management circuit selectively alternates the television between the second state and the third state based on occupancy, between a first state and a second state based on power ON/OFF to the television, and between a first state and a third state based on occupancy and power ON.

Two additional states, which may be considered transitional states, are also shown in FIG. **4**. A wait and standby state (fourth state **56**) and a wait and stay on state (fifth state **58**). The fourth state **56** is respectively located between the second state **52** and third state **54**, while the fifth state **58** is positioned between the first state **50** and the third state **54**. Environment activity statuses **60**-**84** are shown as triggers for various power state control transitions.

A guest or other user turning the television ON/OFF by a remote, for example, at statuses **60**, **62** may trigger the power control circuit to oscillate between the first state **50** and the second state **52**. That is, if the television is ON/operating state (first state **50**) and the television is turned OFF, the power control circuit will activate the power standby state (second state **52**) and visa versa. If the television is in the power standby state (second state **52**) and the television is turned ON, the ON/operating state (first state **50**) is activated.

Occupancy may drive the transition from the second state **52** to the third state **54** as shown by environment activity statuses **64**-**68**, which include a transition through the fourth state **56**. If the room is unoccupied, as detected by an occupancy sensor or a door key entry/exit and relayed wirelessly or through cabling to the power control circuit, the state transitions from the standby state (second state **52**) to the wait and standby state (fourth state **56**), where if a time period, such as 15 minutes, lapses or the guest checks out, the state progresses to the no power/low power state (third state **54**) as shown by the environment activity status **68**. If the room is occupied as detected by some monitor, then the state returns to the standby state (second state **52**) as shown by the environment activity status **64**. Additionally, if a power ON is detected, then the status returns to the ON/operating state (first state **50**) as shown by the environment activity status **84**.

Transitions between the standby state (second state **52**) and the no power/low power state (third state **54**) are also enabled by the guest checking in or checking out as shown by the environment activity statuses **80**-**82**. Through a wireless interface or a network, a message may sent to the power control circuit on the status of the guest, i.e., checking-in or checking-out to change the power status of the television.

With respect to transitions between the power on state (first state **50**) and the no power/low power state (third state **54**), as shown by environmental activity statuses **76**-**78**, the state may change as a result of the guest checking-in or out. Also, as shown by environmental activity statuses **70**-**74**, the wait and stay on status (fifth state **58**) may be transitioned through if the room is detected as unoccupied. If a monitor or other alter informs the power control circuit that the room is no longer occupied, then at wait and stay on status (fifth state **58**), if a time period lapses or the guest checks out, then the state is changed to no power state (third state **54**).

It should be understood that FIG. **4** is presented with a guest as the occupant in a hotel, however, the teachings presented herein may be used by any occupant in any commercial environment. Moreover, it should be understood that various triggers may activate the system and methods presented herein. By way of example, a non-exhaustive list of triggers and state changes is presented in Table I.

TABLE I

Exemplary Triggers & States

Trigger	State Triggered
Check-in	Second State
Check-out	Third State
Door Key Entry	Second State
Occupant Entry	Second State
Occupancy Entry/Exit	Second/Third State
Maid/Staff/Maintenance Entry	Second State
Room Out-of-Service	Third State

Referring to FIGS. **5**A and **5**B, as mentioned, commercial televisions generally require upwards of 20 seconds from the time an end user presses power on a remote or television until a picture is presented for use. The systems and methods presented herein reduce this delay and therefore mitigate resulting guest complaints as while maintaining energy savings. FIG. **5**A is a graph of typical occupied hotel room television usage, wherein time in hours is graphed against television power in Watts. As shown, a comparison is presented of normal television power consumption and power consumption under the power management presented herein. The resulting power savings (PS) over a 24 hour period are indicated by the shading. Similarly, FIG. **5**B is a graph of unoccupied hotel room television usage wherein the power savings (PS) over a 24 hour period are also shown.

By way of example, when placing a television in a commercial environment for independent operation by a customer or end-user, the system power-on can present significant issues for operation, on-going support and costs. Televisions in hotels and other guest-facing environments that turn on slowly do so by charging the system from a stand-by state where very low power is consumed. This power-up from standby can take between 4 and 20 seconds depending on the design of the television. The design proposed here uses control and business rules for a turn-on time for the user less than one second, while providing a net savings in energy. Using a device connected to the television, the video source is connected and available for view except that the television is controlled to:

Power off lighting element (if any) to reduce power consumption and eliminate light coming from the TV in this state.

"Blank" video which maintains the synchronization and stream of video through the television yet does not show it on the screen.

"Blank" audio which may be coming in from the media source and remains available even without video.

Set user indicators on the television (lights, logos, etc) to represent the OFF or Standby state.

When the user presses the power button, the state of the items above to:

Power on lighting element (if any) to ON state

Activate video which has maintained synchronization and stream on the screen

Activate audio which associated with the media source Change user indicators on the television (lights, logos, etc) to represent the ON state.

The power savings elements when combined with controlled system provides the three aforementioned states:

Full Power Off (using ZERO Watts of Power)

Low Power Stand-by State

Accelerated Power Sequencing State

In one embodiment, the implementation described above can be achieved in a stand-alone function with a television in a commercial environment, yet the power consumption will be increased and in this state a television cannot achieve EnergyStar or other low power consumption rating. To reduce energy consumption, one embodiment includes a control system to use three states of power to provide Accelerated Power Sequencing, while providing a net energy savings. In this modality, an operation cycle is as follows:

Room Not In Service—When a room is not designated for service or operation, the control device provides a Power-Off command to the integrated power source to place the TV in a Full Power Off state. When a room is designated for use, either centrally controlled or by interaction of the entry or monitoring control (i.e., a motion sensor) systems, the control device can activate the television to Full Power Off, Low Power Standby or Accelerated Power Sequencing states.

Room Unoccupied—When a room is not occupied or in operation, the control device provides a Power-Off command to the integrated power source to place the TV in a Full Power Off state. In this state, the TV is consuming no power. For facilities like hotels, a guest room is unoccupied for a significant period of time per day and this FULL OFF state can provide energy savings.

Accelerated Power Sequencing State—When room is designated for use, or control device receives notification of door entry or motion, the control device can activate the Accelerated Power Sequencing State based upon business rules for the operation and energy efficiency.

Using business rules established by the operator, the Accelerated Power Sequencing State is activated upon door entry notification or motion and a timer is activated. If desired, this state can be set without a timer and the television will remain in this state if the room is determined to be occupied. With the timer, if it reaches the pre-set time, the control device would send a command to the television to change to Low-Power Standby State.

While this invention has been described with reference to illustrative embodiments, this description is not intended to be construed in a limiting sense. Various modifications and combinations of the illustrative embodiments as well as other embodiments of the invention, will be apparent to persons skilled in the art upon reference to the description. It is, therefore, intended that the appended claims encompass any such modifications or embodiments.

What is claimed is:

1. A system for television state power control, the system comprising:

a television including a screen having an image display engine associated therewith, the television including a video feed providing a video signal and an audio feed providing an audio signal, the television including a visual indicator;

a power management circuit interposed between the video feed and the image display engine, the power management circuit in communication with the visual indicator and interposed between the audio feed and speakers associated with the television, the power management circuit configured to selectively alternate the television between a first state, a second state, and a third state;

a receiver coupled to the power management circuit, the receiver configured to receive an activity signal relative to environment activity status;

the first state including the power management circuit passing the video signal to the image display engine and the power management circuit passing the audio signal to the speaker, the first state including the visual indicator displaying television on;

the second state including the power management circuit blanking the video signal to the image display engine such that a blank video image is displayed on the television, the power management circuit maintaining synchronization of the video signal with the image display engine, and the power management circuit blocking the audio signal to the speaker, the second state including the visual indicator displaying television off;

the third state including the power management circuit turning the video feed off, the power management circuit turning the audio feed off, the third state including the visual indicator displaying television off, the second state and the third state having identical visual indicators;

the power management circuit selectively alternates the television between the second state and the third state based on guest occupancy of a commercial lodging environment relative to check-in and check-out of the commercial lodging environment; and

the power management circuit selectively alternates the television between the first state and the third state based on the guest occupancy of check-in and power on;

the power management circuit selectively alternates the television between the first state and the second state based on the guest occupancy of check-in and power on/off to the television; and

the power management circuit selectively alternates the television between the first state and the second state, between the second state and the third state, and between the first state and the third state.

2. The system as recited in claim **1**, further comprising a fourth state including the power management circuit passing the video signal to the image display engine and the power management circuit passing the audio signal to the speaker, the fourth state including the visual indicator displaying television ON, the fourth state including a timer decrementing a time period.

3. The system as recited in claim **1**, further comprising the fifth state including the power management circuit blanking the video signal to the image display engine, while maintaining synchronization with the image display engine, and the power management circuit blocking the audio signal to the speaker, the fifth state including the visual indicator displaying television OFF, the fifth state including a timer decrementing a time period.

4. The system as recited in claim **1**, wherein the power management circuit forms a portion of the television.

5. The system as recited in claim **1**, wherein the power management circuit forms a portion of a set top/back box located in communication with the television.

6. The system as recited in claim **1**, wherein the receiver further comprises a wireless receiver coupled to the power management circuit, the wireless receiver configured to receive a wireless activity signal from a monitoring unit located proximate to the television.

7. The system as recited in claim **1**, wherein the receiver further comprises an input coupled to the power management circuit, the input configured to receive data relative to environment activity status from a networked source.

8. The system as recited in claim **1**, wherein the first state further comprises an optimization for an occupied and power ON television.

9. The system as recited in claim **1**, wherein the second state further comprises an optimization for an occupied an power OFF television.

10. The system as recited in claim **1**, wherein the third state further comprises an optimization for an unoccupied an power OFF television.

11. A power management circuit for efficient television power state control, the power management circuit comprising:

a wireless transceiver configured to communicate with a proximate wireless-enabled monitor and receive data relative to environment activity status;

an input configured to receive data relative to environment activity status from a networked source;

a processor coupled to the wireless transceiver and the input, the processor configured to communicate with a video feed, an audio feed, an image display engine, and a visual indicator;

a memory accessible to the processor, the memory including processor-executable instructions that, when executed, cause the processor to selectively alternate between a first state, a second state, and a third state based on received data relative to the environment status:

in the first state, drive first signaling to pass the video signal to the image display engine and pass the audio signal to a speaker, the first signaling including the visual indicator displaying television on,

in the second state, drive second signaling to blank the video signal to the image display engine such that a blank video image is provided on the signal for display, the power management circuit maintaining synchronization of the video signal with the image display engine, the second signaling including blocking the audio signal to the speaker, the second signaling including the visual indicator displaying television off, the second state and the third state having identical visual indicators, and

in the third state, drive third signaling to turn the video feed off and to turn the audio feed off, the third signaling including the visual indicator displaying television off;

the processor selectively alternates the television between the second state and the third state based on guest occupancy of a commercial lodging environment relative to check-in and check-out of the commercial lodging environment; the processor selectively alternates the television between the first state and the third state based on the guest occupancy of check-in and power on;

the power management circuit selectively alternates the television between the first state and the second state based on the guest occupancy of check-in and power on/off to the television; and

the power management circuit selectively alternates the television between the first state and the second state, between the second state and the third state, and between the first state and the third state.

12. The power management circuit as recited in claim **11**, wherein the processor-executable instructions further comprise, when executed, the processor to decrement a timer period.

13. The power management circuit as recited in claim **12**, wherein prior to selectively alternating between the first state and the third state, the processor decrements the time period to zero.

14. A system for television state power control, the system comprising:

a television including a screen having an image display engine associated therewith, the television including a video feed providing a video signal and an audio feed providing an audio signal, the television including a visual indicator;

a power management circuit interposed between the video feed and the image display engine, the power management circuit in communication with the visual indicator and interposed between the audio feed and speakers associated with the television, the power management circuit including means for selectively alternating the television between a first state, a second state, and a third state;

receiving means for receiving an activity signal relative to environment activity status;

the first state including the power management circuit passing the video signal to the image display engine and the power management circuit passing the audio signal to the speaker, the first state including the visual indicator displaying television on;

the second state including the power management circuit blanking the video signal to the image display engine such that a blank video image is displayed on the television, the power management circuit maintaining synchronization of the video signal with the image display engine, and the power management circuit blocking the audio signal to the speaker, the second state including the visual indicator displaying television off, the second state and the third state having identical visual indicators;

the third state including the power management circuit turning the video feed off, the power management circuit turning the audio feed off, the third state including the visual indicator displaying television off;

the power management circuit selectively alternates the television between the second state and the third state based on guest occupancy of a commercial lodging environment relative to check-in and check-out of the commercial lodging environment;

the power management circuit selectively alternates the television between the first state and the third state based on the guest occupancy of check-in and power on; and

the power management circuit selectively alternates the television between the first state and the second state based on the guest occupancy of check-in and power on/off to the television; and

the power management circuit selectively alternates the television between the first state and the second state, between the second state and the third state, and between the first state and the third state.

15. The system as recited in claim 14, further comprising a fourth state including the power management circuit passing the video signal to the image display engine and the power management circuit passing the audio signal to the speaker, the fourth state including the visual indicator displaying television ON, the fourth state including a timer decrementing a time period.

16. The system as recited in claim 14, further comprising a fifth state including the power management circuit blanking the video signal to the image display engine, while maintaining synchronization with the image display engine, and the power management circuit blocking the audio signal to the speaker, the fifth state including the visual indicator displaying television OFF, the fifth state including a timer decrementing a time period.

17. The system as recited in claim 14, wherein the guest occupancy further relates to a hotel guest.

18. The system as recited in claim 1, wherein the guest occupancy further relates to a hotel guest.

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